Earnings of Asian Immigrant Computer Scientists: The Effect of Degree Origin

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Abstract— **In the U.S., science and engineering (S&E) attracts a large proportion of Asian workers, and a majority of them are foreign-born [1]. Among the foreign-born, a small proportion but a considerable number of them are foreign-degreed [2]. However, not much attention in sociology has been paid to the foreign-degreed yet. This study examines the effect of degree origin on the salaries of full-time, college-educated Asian immigrant computer scientists in the U.S. This study employs a sample of 2,522 observations derived from the 1993 and 2003 National Survey of College Graduates (NSCG) conducted by the National Science Foundation. Results from multivariate regressions show that degree origin had a statistically significant effect in 1993 but not in 2003. The negative effect of the highest degree from an Asian institution in 1993 can be attributed to the perceived lower quality of education in Asia and the choice that Asian-degreed computer scientists made. The disappearance of this effect in 2003 may be explained by the improvement in the quality of education in Asia and an increase in the demand for computer scientists in the U.S. between 1993 and 2003.**

Keywords-Asian, Immigrant Computer Scientists, Earnings, Degree Origin

I. INTRODUCTION

In science and engineering (S&E) fields, Asians, especially foreign-born Asians, are overrepresented in terms of degree production and workforce participation, especially in fields such as computer science and engineering [1]. Yet, partly due to their overrepresentation, studies of scientists and engineers typically neglect Asians. Most scholarly attention in this line has been paid to white women and, to a limited extent, racial/ethnic minorities, such as African Americans and Hispanics.

Among all scientists and engineers in the U.S., the foreign-born represent a considerable share. The share was especially high among Asians—in 2003, while about 16% of all scientists and engineers (with at least a bachelor's degree in S&E or at least a bachelor's degree in other fields but working in S&E occupations) in the U.S. were immigrants, about 83% of Asian scientists and engineers were foreign-born. The largest proportion of foreign-born scientists and engineers came to the U.S. due to family-related reasons (37%), and others came for education (30%), job or economic opportunities (21%), and professional or scientific infrastructure (5%). Some of them came when they were infants, some earned degrees in both the U.S. and other countries, and others completed education before coming to the U.S. [2]. However, few studies of scientists and engineers distinguish those who received highest degrees in other countries from those in the U.S.

Nevertheless, where one completed education influences earnings. Reference [3] examines the earning disadvantage of Asian American male workers in the U.S. They find that while U.S.-born Asian Americans and Asian immigrants who finished education in the U.S. were not disadvantaged due to their race and nativity, respectively, those who completed education before moving to the U.S. were disadvantaged due to the origin of their education. Thus, the previously recorded earning disadvantage of Asian Americans in the U.S. is explained by the foreign education which is valued less than U.S. education in the U.S. workplace. Although their study does not focus on Asian scientists and engineers but Asian workers of all occupations, it reveals an important factor that studies of scientists and engineers should consider, i.e., the origin of one's education, or more specifically, the highest degree.

Thus, testing the effect of degree origin on the earnings of Asian scientists and engineers provides an excellent opportunity to fill gaps in knowledge concerning the understudied Asian S&E workers. More specifically, in this study, I test the effect of degree origin on the earnings of Asian computer scientists. In addition, this study examines the change of the effect of degree origin over time. The results add to literature disaggregated findings regarding the earnings of the understudied Asian scientists and engineers. This paper is organized in four parts: 1) literature review, 2) data and methods, 3) findings, and 4) discussions and conclusions.

II. LITERATURE REVIEW

A. The Career Advancement of Asian Scientists and Engineers in the U.S.

Studies of Asian scientists and engineers in the U.S. have reported barriers they experience in their careers. Some of these studies distinguish foreign-born from native-born Asians, and others group them into one category. Reference [4] finds that in engineering, Asians in general and foreign-born Asians in specific are more likely than their white counterparts to be unemployed. Furthermore, Asians as a group are less likely than their white counterparts to be employed in academe. In academia, Asian immigrant engineers are concentrated in R&D, their "niche" fields, due to their preference and others' expectation on their technical excellence. While Asians are more likely to do technical jobs, whites are more likely to take

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managerial tasks. Asians have 34% lower odds of being in general management than their white counterparts. The same pattern holds true regardless of nativity. Asians also have 31% lower odds of holding R&D management positions, and this pattern holds true especially for the foreign-born. In short, well-educated minority engineers have not transferred their skills to corresponding rewards.

Reference [5] explores the career attainment of Asian Indian immigrant scientists and engineers, immigrants who have received a master's or a doctoral degree and are not on temporary working visas (i.e., H1-B). A majority of these Asian Indian immigrant scientists and engineers find that they experience a "silicon ceiling." More specifically, in terms of earnings, about 15% of Asian Indian immigrant scientists and engineers believe that they are paid less than their colleagues, notably whites, but have never taken actions, and 4% have actually taken actions to get their salaries corrected. Nevertheless, Asian Indian immigrant scientists and engineers believe and accept as a reality that they have to work harder and outperform their peers to be paid the same. In terms of promotion, 34% report more time they had to wait for promotion than their peers.

The "glass ceilings" that Asian scientists and engineers experience in their careers are consistently recorded in the few studies of Asian scientists and engineers in the U.S. Despite being qualified, Asian candidates for managerial positions are underrepresented in management or administration in industry, government, and academia. If an organization has a dual career ladder, i.e., technical and managerial, Asians are often overrepresented in the former and underrepresented in the latter. Some scholars attribute Asians' low representation in managerial positions, in both the industry and academic settings, to the lack of clear promotion process and evaluation standards. Oftentimes, Asian scientists and engineers are passed over for promotion, and they often feel that they need to be better than others to receive recognition [5], [6], [7], [8], [9]. In terms of satisfaction, Asian scientists and engineers are clearly not satisfied with their salaries, promotion and other opportunities in their careers, and the quality of life [6].

In addition to unclear promotion process and evaluation standards, other factors that contribute to Asians' concentration in technical rather than administrative positions are cultural and institutional. Stereotypes define that Asians lack human-relations skills, aggressiveness, and English proficiency [6], [7], [9]. These claims work especially against immigrant Asian S&E workers. In addition, Asians lack access to the "old boys' network" and mentoring, especially by Asian managers as mentors, which may be related to the fact that they do not know as much as their peers how the promotion system works [5], [9]. Furthermore, they do not receive management training which can lead trainees into managerial positions. Neither do they have access to important developmental assignments which can lead to visibility in the organization [9]. Their disadvantages in the promotion process can also negatively influence their earnings.

B. *Earnings of Foreign-born Scientists and Engineers in the U.S.*

While studies of Asian scientists and engineers do not always disaggregate them by nativity, other studies examine immigrant scientists and engineers and compare college-educated immigrant and native workers. Reference [10] reports that when controlling for factors, such as education, field, age, marital status, race or ethnicity, class, and industry, they find that college-educated immigrant scientists and engineers earned less than their native-born counterparts by 4.4% in 1989 and 9.3% in 1996. Although this study does not focus on Asians, the results reveal the relative disadvantage of foreign-born scientists and engineers.

Reference [11] hypothesizes that earning differentials due to country-specific human capital may be smaller for workers with at least a college degree because college education is less country-specific than other forms of human capital. Furthermore, about half of the immigrant professionals have received formal training in the U.S. before working in the U.S. He finds that, among natives and immigrants with at least a college degree, excluding the self-employed and people of disability, no differentials in returns to education and to U.S. work experience exist. However, he finds some differences in returns to marriage, residence in metropolitan areas, and some occupations, such as health, postsecondary teaching, and social sciences, in which immigrants earn more than natives, as well as humanities and technical and administrative support, in which immigrants earn less than natives.

In sum, the above studies reveal that for Asian and immigrant scientists and engineers, their training does not benefit them in earnings and mobility to the same extent as their white and native-born counterparts, respectively. Furthermore, the disadvantages of Asian and immigrant scientists and engineers have not been eliminated over time. However, these studies tend to lump Asian or immigrant scientists and engineers into one group and do not distinguish the U.S.-educated from the foreign-degreed. Yet, the earning disadvantage of foreign-educated Asian male workers due to the place of education [3].

Based on the reviewed literature, this study tests the following hypothesis: *1. Asian-degreed Asian computer scientists earn less than their U.S.-degreed counterparts.* In addition, as literature shows, since the earning differences between immigrant and native-born scientists and engineers did not eliminate over time, the earning difference between Asian- and U.S.-degreed would likely not change much over time. Thus, this study tests the second hypothesis: *2. The earning difference between Asian-degreed Asian computer scientists and their U.S.-degreed counterparts slightly changed from 1993 to 2003*.

III. Data and Methods

Data are obtained from the National Survey of College Graduates (NSCG) conducted by the National Science Foundation (NSF). The NSCG survey began in 1993, and the sample with bachelor's or higher degrees was derived from the 1990 census, but some of these individuals received another (the highest) degree between 1991 and 1993. The 2003 dataset

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used the samples of 2000 census and of another NSF data set, the 2001 National Survey of Recent College Graduates (NSRCG). Similar to the 1993 NSCG sample, the 2003 NSCG sample includes people who received their degrees by April 1, 2000 and also between 2001 and 2003. One caution is that foreign-educated people in the sample were not well covered. Therefore, care should be given in interpreting the representativeness of this group. Nevertheless, due to the limited attention paid to the effect of the origin of the highest degree on the earnings of S&E workers, examining this effect is worthwhile.

The NSCG data sets have nationally representative samples of people with at least a bachelor's degree in S&E or S&E-related fields and working in those fields. The samples of the surveys include computer scientists who were born and earned their degrees in or outside the U.S., up to 76 years of age. This study uses data collected in both 1993 and 2003 to examine the change from 1993 to 2003. In total, the 1993 sample had 795 Asian-born computer scientists (68% of them are men and 32% are women), and the 2003 sample contained 1,727 Asian-born computer scientists (74% are men and 26% are women). Clearly, in both years, men far outnumbered women. This study excludes Asian computer scientists who were born outside Asia in the 1993 and 2003 samples. In addition, it excludes those who received highest degrees in places other than the U.S. or Asia.

Asian immigrants in this study are all self-reported non-Hispanic Asians who were born in Asia and were naturalized U.S. citizens, permanent residents, or temporary residents. They received a bachelor's, a master's, or a doctoral degree as the highest degree in the U.S. or Asia. They are classified into two groups based on the origin of their highest degrees: U.S.-educated immigrants and Asian-educated immigrants. All Asian computer scientists included in this study were full-time workers whose occupation for the principal job was computer scientists in 1993 or 2003.

To test the effect of degree origin and its change from 1993 to 2003, this study uses multivariate regression, or ordinal least square (OLS) regression. The dependent variable in this study is the natural logarithm of the annualized salary. The key independent variable is the dummy variable, being Asian-degreed. Control variables in this study include personal, educational, and employment characteristics.

Personal characteristics include gender (male=1), marital status (married=1), having at least a child, age, age-squared, citizenship status, and the interaction terms of gender and being married and of gender and having children. Studies have shown gender differences, and that being married and having children can also influence a scientist's or an engineer's performance, which may be related to their earnings. Older age often leads to higher salaries, and the age-square variable is used to determine whether salary increases or decreases in a linear or nonlinear way. Citizenship status is potentially important in that they can be proxies of the level of assimilation [4], which may influence earnings. Previous studies also show that marriage and children have different impact on the career advancement of women than on that of male scientists. The interaction terms can test the different effects of marriage and children on men and women.

Educational characteristics include the degree level (i.e., bachelor's, master's, doctoral, excluding professional degrees) and the field of the highest degree. Different degree levels should yield different earnings, as the human capital theory holds [12], [13]. Engineers trained in fields other than engineering may have qualifications different from those trained in engineering programs, which may influence their salaries.

Employment characteristics include employment sector, work experience, experience-squared, supervisory status, principal work activities, and location. Similar to age, longer work experience often leads to an increase in the salary, and its square term can show whether the increase is linear or curvilinear. Since experience is a proxy of years since the highest degree, age can capture some of the mismeasurement of experience. Supervisors often earn more than non-supervisor workers, and different principal work activities typically lead to different salaries, especially if one compares those whose work activity is management and those whose main activity is teaching. In terms of employment sector, self employment may reward workers differently from non-profit and for-profit organizations [14], although all of them are in industrial settings. Employment locations also have direct impacts in that some regions, such as New England and the Pacific regions, have higher living costs than others, and thus, employees are expected to earn more in the former than the latter.

IV. FINDINGS

A. Descriptive Results

In 1993, compared with their U.S.-degreed counterparts, Asian-degreed immigrants were older, on average (Table 1). A larger proportion of the Asian-degreed than the U.S.-degreed was married, had children, and was permanent or temporary residents. A much larger share of the Asian-degreed immigrants earned the bachelor's and a smaller proportion of them earned the master's or the doctorate as the highest degree.

Most of the U.S.- and Asian-degreed immigrants worked in for-profit firms, but a larger proportion of the former worked in educational institutions and federal government, and a larger share of the latter worked in non-profit organizations and state/local government. Possibly related to their higher mean age, Asian-educated immigrants had longer years of work experience than the U.S.-degreed but had similar percentage working as supervisors. In terms of work activities, most of both groups worked in computer applications, but the former were proportionately more likely to work in research and development but less likely to work in management and administration than the latter. Among the nine employment regions, those with the largest proportion of both groups were the Pacific, Middle Atlanta, and South Atlantic regions.

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TABLE I. MEAN CHARACTERISTICS OF FULL-TIME ASIAN-BORN ASIAN COMPUTER SCIENTISTS, 1993 AND 2003

	1993		2003	
Variables	U.S.-degreed	Asian-degreed	U.S.-degreed	Asian-degreed
Mean age	37.4	41.7	39.3	36.8
% Married	79.1	85.3	83.4	90.7
% Having children	59.6	66.2	63.9	68.7
Citizenship Status				
% Naturalized U.S. citizen	63.4	49.3	64.0	21.6
% Perm. resident	32.6	42.7	25.4	51.4
% Temp. resident	4.0	8.1	10.6	27.0
Highest Degree				
% Bachelor's	34.6	76.5	26.2	60.9
% Master's	56.2	20.6	62.6	35.6
% Doctorate	9.3	2.9	11.2	3.5
Employment Sector				
% Ed. institution	6.1	2.9	5.8	2.1
% For-profit firm	83.8	83.1	85.2	90.1
% Self-employment	1.5	0.7	1.6	1.1
% Non-profit org.	1.8	6.6	2.0	3.0
% Federal gov't	3.8	1.5	2.3	0.9
% State/local gov't	3.0	5.2	3.1	2.8
Mean work experience	9.3	18.0	10.5	13.5
% Supervisor	31.3	30.9	32.6	31.3
Primary Work Activities				
% R&D	15.0	8.1	20.0	14.7
% Teaching	2.0	1.5	1.5	0.2
% Management and admin.	6.8	16.2	11.3	8.6
% Computer application	73.0	69.9	63.5	73.6
% Other work activities	3.2	4.4	3.8	3.0
Employer Region				
% New England	5.8	4.4	4.8	6.3
% Middle Atlantic	18.5	24.3	17.1	21.2
% East North Central	9.9	8.8	12.2	13.6
% West North Central	4.3	2.9	3.6	3.5
% South Atlantic	10.6	12.5	14.5	15.3
% East South Central	1.2	0.7	1.6	2.4
% West South Central	9.1	2.9	9.9	6.2
% Mountain	3.0	2.2	2.2	3.4
% Pacific	37.6	41.2	34.1	28.1
Number	659	136	1190	537

[a]Source: National Survey of College Graduates, 1993 and 2003.

In 2003, most patterns were similar. Here, I highlight the differences. Asian-degreed immigrants were younger than their U.S.-degreed counterparts in 2003 (Table 1). Compared with the same group in 1993, a larger proportion of Asian-degreed immigrants were younger and were permanent or temporary residents. While they still earned proportionately more bachelor's degrees and proportionately fewer graduate degrees than the U.S.-degreed, their shares of graduate degrees increased in 2003. In terms of employment locations, in addition to the three large regions where over two thirds worked in 1993, in 2003, East North Central attracted over 10% of each group.

Since earnings often vary due to the level of education [12], [13], I report mean salaries by degree level in Table 2. In 1993, U.S.-degreed immigrants with a bachelor's as the highest degree earned a mean salary of $49,689, or about $63,272 in the 2003 currency. At the master's and the doctoral levels, the mean salaries were 112% and 133% as much as that at the bachelor's level. Asian-degreed immigrants with a bachelor's and a master's as the highest degree earned less than the U.S.-degreed at the same degree level. However, at the doctoral level, Asian-degreed immigrants earned much more than the Asian-degreed. In 2003, among those whose highest degree was the bachelor's, Asian-degreed immigrants earned more than their U.S.-degreed counterparts. Yet, at the master's and doctoral levels, U.S.-degreed immigrants earned more than their Asian-degreed counterparts.

B. Multivariate Regression Results

Multivariate regression results show that after other variables are controlled for, Asian-degreed immigrants earned significantly less than their U.S.-degree counterparts in 1993—they earned 80.4% as much as their U.S.-degreed counterparts. However, this negative effect disappeared in 2003 (Table 3).

Some control variables significantly influenced earnings. While other variables are held constant, in 1993, with each additional year of age, earnings increased at a decreasing rate till 38 years of age and then decreased at an increasing rate. However, this effect disappeared in 2003. Other personal characteristics, such as martial status, having children, the interaction terms of both variables with gender, and citizenship status were not statistically significant in both years.

In terms of educational characteristics, having a master's and a doctoral degree as the highest degree led to an increase in earnings in both years. Compared with computer science, receiving a highest degree in engineering and physical sciences did not lead to earning differences, but earning the highest degree in other fields had some negative impact in either year.

TABLE II. MEAN SALARIES OF ASIAN-BORN ASIAN COMPUTER SCIENTISTS, BY DEGREE LEVEL, 1993 AND 2003 (IN 2003 DOLLARS)

	1993		2003	
Degree Level	*U.S.-degreed*	*Asian-degreed*	*U.S.-degreed*	*Asian-degreed*
Bachelor's	$63,272	$56,664	$74,462	$77,566
Master's	112%	112%	112%	104%
Doctoral	133%	197%	124%	105%

[a]Source: National Survey of College Graduates, 1993 and 2003.

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TABLE III. ESTIMATED REGRESSION COEFFICIENTS FROM EARNING ESTIMATIONS, 1993 AND 2003

	1993		2003	
Variables	***Coeff.***	***Robust S.E.***	***Coeff.***	***Robust S.E.***
Asian-degreed	-0.218***	(0.049)	-0.0424	(0.026)
Male	0.0146	(0.055)	0.135	(0.080)
Age	0.0380*	(0.017)	-0.00194	(0.015)
Age-squared	-0.0005*	(0.00021)	-0.000001	(0.00018)
Married	-0.00779	(0.057)	0.112	(0.067)
Having children	-0.0165	(0.052)	0.0133	(0.035)
Female*married	0.0941	(0.072)	-0.0764	(0.075)
Female*children	0.00722	(0.062)	0.0174	(0.046)
Citizenship Status (Reference: U.S. citizens)				
Permanent resident	-0.00855	(0.030)	0.00660	(0.025)
Temporary resident	-0.0684	(0.069)	-0.0304	(0.031)
The Type of the Highest Degree (Reference: the Bachelor's)				
Master's	0.130***	(0.027)	0.0861***	(0.025)
Doctoral	0.393***	(0.058)	0.215***	(0.035)
The Field of the Highest Degree (Reference: Computer and mathematical sciences)				
Engineering	-0.0390	(0.028)	-0.0220	(0.021)
Physical sciences	-0.0888	(0.094)	0.00424	(0.040)
Biological sciences	-0.151	(0.12)	-0.196*	(0.099)
Social sciences	-0.111	(0.071)	-0.157*	(0.076)
Other fields	-0.0839*	(0.038)	-0.0546	(0.031)
The Employment Sector (Reference: Educational institutions)				
Self-employment	0.647***	(0.17)	-0.133	(0.20)
For-profit	0.325***	(0.067)	0.316***	(0.068)
Non-profit	0.315**	(0.10)	0.265**	(0.096)
Federal government	0.335***	(0.089)	0.309**	(0.11)
State/local gov't	0.109	(0.083)	0.141	(0.078)
Work experience	0.0233***	(0.0056)	0.0292***	(0.0085)
Work experience–sq	-0.000296*	(0.00014)	-0.00070*	(0.00031)
Supervisor	0.122***	(0.024)	0.0899***	(0.021)
The Type of Primary Work Activity (Reference: Management and Admin)				
Teaching	-0.0950	(0.11)	0.0705	(0.086)
R&D	0.0378	(0.057)	0.00723	(0.039)
Computer application	-0.0167	(0.046)	-0.0348	(0.035)
Other work activities	-0.139	(0.087)	-0.189*	(0.089)
Observations	795		1727	
R-squared	0.32		0.19	

[a]Employment locations are also included in the regression models but not reported in the table. They include 1) New England, 2) Middle Atlantic, 3) East North Central, 4) West North Central, 5) South Atlantic, 6) East South Central, 7) West South Central, 8) Mountain, and 9) Pacific.

[b]*** coefficient significant at 0.001 level ; ** coefficient significant at 0.01 level; * coefficient significant at 0.05 level

In terms of employment characteristics, in both years, compared with their counterparts working in educational institutions, those working in for-profit firms, non-profit organizations, and federal government earned more but those employed in the state/local government did not earn more or less. However, the self-employed earned more than their counterparts working in educational institutions in 1993 but not differently in 2003. The effect of work experience, or years since the highest degree, was statistically significant in both years. In 1993, each additional year since the highest degree led to an earning increase at a decreasing rate till 39.4 years and then started to decrease at an increasing rate. In 2003, the earning increase peaked at 20.9 years after receiving the highest degree and then decreased at an increasing rate. Being a supervisor also increased earnings, but compared with management and administration, most work activities did not lead to an earning advantage or disadvantage in both years. Employment locations were included in the models but their effects were not reported in the table. In 1993, compared with New England, two regions, West North Central and East South Central, paid comparable workers less, but in 2003, there was no significant difference among the nine employment regions.

V. DISCUSSIONS AND CONCLUSIONS

Hypothesis 1 is supported in that Asian-degreed Asian computer scientists earned less than their U.S.-degreed counterparts in 1993. Hypothesis 2 is partially supported in that the earning difference between Asian-degreed and their U.S.-degreed counterparts changed over time—it existed in 1993 but disappeared in 2003. The disadvantage of Asian-degreed computer scientists in 1993 could be attributed to two major factors associated with Asian-degreed immigrants, namely, the origin of their highest degrees and their choice of not receiving a higher degree (if their Asian degrees were not doctorates) after coming to the U.S. The failure to find such an effect in 2003 suggests that these two aspects changed and the increase of demand for computer scientists between 1993 and 2003.

First of all, degrees from Asian institutions may not be valued as much as U.S. degrees in the U.S. workplace. Studies reveal that a common disadvantage of education among some countries in Asia, especially East Asia, is that it does not promote creativity. East Asian countries often emphasize and expect memorization and repetition at the cost of creativity. In East Asia, creativity can be stifled to a large degree through the practices of rote learning and a work-play dichotomy with a devaluation of play, the value system that emphasizes obedience and loyalty, and the hierarchical structure that expects different gender roles and the authority of teachers. People avoid behaving differently from others and are afraid of making mistakes or feeling embarrassed because of the mistakes, which can keep them silent in class. In Korea, the goal of education is to prepare students to pass examinations. Teachers teach to the test, students study to pass exams, and teaching and learning do not promote critical and creative thinking skills. In short, influenced by its culture, education in some Asian countries tends not to foster creativity [15]. In the U.S. workplace and culture that value creativity, critical thinking, and problem solving skills, an education that does not

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promote and foster creativity may be valued less than that emphasizing critical thinking and problem solving.

More specifically, Asian higher education in S&E lags behind that in the U.S. One problem is the shortages of first-class faculty and resources, which prevent Asian universities from providing high-quality education, especially at the doctoral level [16], [17]. The lack of resources and faculties also result in a lack of mentoring to students [18]. In China, S&E education focuses on theory, and the lack of "real-world" experience make Chinese graduates less competitive than graduates in the U.S. or other countries in the global labor market [19], [20]. However, what is worth mentioning is that resources for S&E research and education in Asian countries have been improved in the later half of the 1990s and the early 2000s [1]. In the 1980s and the early 1990s, S&E education in Asia was in a worse situation due to a severe lack of resources. For instance, in China, science and engineering education had a severe setback in the 1960s and 1970s due to the Cultural Revolution. In computer science education at the college level, China made substantial progress in many aspects in the late 1980s, such as developing computing machines and software and obtaining equipment from overseas. However, problems remained. They included a lack of latest hardware and software, research journals, and textbooks. In addition to the lack of facilities, China had a shortage of teachers in computer science in the 1980s [21]. Although the quality of S&E education in most Asian institutions is still not yet up to the U.S. standard, the improvement in resources may have a positive effect on the earnings of Asian-trained computer scientists.

Another aspect of education is English education. A common problem with the English education in Asia is the lack of well-trained teachers at all levels. Studies find that in Asian countries, including Mainland China, Hong Kong, Japan, Korea, Malaysia, Taiwan, and Vietnam, teachers in public-sector institutions do not receive adequate training. Even in more developed regions and countries, such as Hong Kong, which has spent millions of dollars in teacher education in recent years, the wide use of nonqualified English teachers and a decrease in the share of qualified English teachers in public schools exist and are quite problematic [22]. Nevertheless, over time, English learning has improved due to the society's more open attitude to English and better access to learning facilities. Reference [23] finds that in a survey of English learners in China, younger cohorts report statistically significantly more foreign-language class time as well as teacher's use of the target language in class in elementary, secondary, and tertiary institutions. More and better facilities, such as tape recorders, more books, and campus radio, became available to younger cohorts, and learners also became more open to speaking and practicing English than older cohorts.

The second major issue that may explain the earning difference between comparable U.S.- and Asian-degreed Asian computer scientists is the difference in their choices. The U.S.-degreed may be more ambitious than their Asian-degreed counterparts in that a much larger share of the former had the master's and the doctoral degrees than the latter (as shown in Table 1). With a degree from an Asian institution, the Asian-degreed may be underemployed in the U.S. Although they may earn less than other workers with similar education credentials in the U.S., they still earn more than their counterparts in Asia [24]. This situation may be especially true in 1993, when over three quarters of the Asian-degreed had the bachelor's as the highest degrees. In 2003, a smaller proportion of Asian-degreed computer scientists had the bachelor's as the highest degree.

In addition to the improvement in education in Asia and the change of behavior, such as attaining a higher degree after coming to the U.S., another factor may contribute to the change in the U.S.-Asian degreed earning disparity from 1993 to 2003. It is the increasing demand for computer scientists during the period. In the past a few decades, S&E workforce grew to a larger extent than the general workforce in the U.S. Among S&E fields, the growth of computer-related jobs was the largest—the change from 1983 to 2000 was 250% [25]. Another report shows that from 1995 to 2005, the changes in salaries in the science and engineering workforce were similar to those in the general workforce. Among the S&E workforce, the highest salary rates were found among mathematical and computer scientists and engineers. With an increasing demand, the origin of a computer scientist's highest degree may be overshadowed [26].

This study explores the effect of degree origin on earnings among full-time, college-educated Asian-born computer scientists in the U.S. and the change of this effect from 1993 to 2003. It also leaves some questions for future research. It is worth mentioning that the effects of some independent variables, such as gender, that have been proved to influence earnings, are not statistically significant in this study. It suggests that gender does not statistically significantly influence the earnings of Asian immigrant computer scientists in the sample. It does not necessarily mean that Asian female (and/or Asian male) immigrant computer scientists do not earn less than other groups, such as their U.S.-born Asian or their white men or white women counterparts. Future studies on Asian scientists and engineers should examine gender differences and racial differences in the effect of degree origin on earnings.

Furthermore, this study does not investigate the nationality differences among Asian-educated immigrant computer scientists. Future research can examine Asian-educated immigrants of which countries actually earned less than their U.S.-educated counterparts while those of other countries did not or even earned more.

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